

1 WHAT IS CLAIMED IS:

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1. A microphone array apparatus comprising:  
- a microphone array including microphones,  
one of the microphones being a reference microphone;  
filters receiving output signals of the  
10 microphones; and  
a filter coefficient calculator which  
receives the output signals of the microphones, a  
noise and a residual signal obtained by subtracting  
filtered output signals of the microphones other than  
15 the reference microphone from a filtered output signal  
of the reference microphone and which obtain filter  
coefficients of the filters in accordance with an  
evaluation function based on the residual signal.

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2. The microphone array apparatus as  
claimed in claim 1, further comprising:

25 delay units provided in front of the  
filters; and

30 a delay calculator which calculates amounts  
of delays of the delay units on the basis of a maximum  
value of a crosscorrelation function of the output  
signals of the microphones and the noise.

35 3. The microphone array apparatus as  
claimed in claim 1, wherein the noise is a signal  
which drives a speaker.

1           4. The microphone array apparatus as  
claimed in claim 1, further comprising a supplementary  
microphone which outputs the noise.

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10           5. The microphone array apparatus as  
claimed in claim 1, wherein the filter coefficient  
calculator includes a cyclic type low-pass filter  
which applies a comparatively small weight to memory  
values of a filter portion which executes a  
convolutional operation in an updating process of the  
filter coefficients.

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20           6. A microphone array apparatus comprising:  
a microphone array including microphones;  
linear predictive filters receiving output  
signals of the microphones;  
linear predictive analysis units which  
receives the output signals of the microphones and  
25 update filter coefficients of the linear predictive  
filters in accordance with a linear predictive  
analysis; and  
a sound source position detector which  
obtains a crosscorrelation coefficient value based on  
30 linear predictive residuals of the linear predictive  
filters and outputs information concerning the  
position of a sound source based on a value which  
maximizes the crosscorrelation coefficient value.

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1           7. The microphone array apparatus as  
claimed in claim 6, wherein:  
              a target sound source is a speaker; and  
              the linear predictive analysis unit updates  
5        the filter coefficients of the linear predictive  
filters by using a signal which drives the speaker.

10           8. A microphone array apparatus comprising:  
              a microphone array including microphones;  
              a signal estimator which estimates positions  
15      of estimated microphones in accordance with intervals  
at which the microphones are arranged by using the  
output signals of the microphones and a velocity of  
sound and which outputs output signals of the  
estimated microphones together with the output signals  
of the microphones forming the microphone array; and  
20           a synchronous adder which pulls phases of  
the output signals of the microphones and the  
estimated microphones and then adds the output  
signals.

25           9. The microphone array apparatus as  
claimed in claim 8, further comprising a reference  
30        microphone located on an imaginary line connecting the  
microphones forming the microphone array and arranged  
at intervals at which the microphones forming the  
microphone array are arranged,  
              wherein the signal estimator which corrects  
35        the estimated positions of the estimated microphones  
and the output signals thereof on the basis of the  
output signals of the microphones forming the

## 1 microphone array.

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10. The microphone array apparatus as claimed in claim 9, further comprising an estimation coefficient decision unit weights an error signal which corresponds to a difference between the output signal of the reference microphone and the output signals of the signal estimator in accordance with an acoustic sense characteristic so that the signal estimator performs a signal estimating operation on a band having a comparatively high acoustic sense with a 15 comparatively high precision.

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11. The microphone array apparatus as claimed in claim 8, wherein:

given angles are defined which indicate directions of a sound source with respect to the 5 microphones forming the microphone array;

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the signal estimator includes parts which are respectively provided to the given angles;

the synchronous adder includes parts which are respectively provided to the given angles; and

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the microphone array apparatus further 30 comprises a sound source position detector which outputs information concerning the position of a sound source based on a maximum value among the output signals of the parts of the synchronous adder.

1           12. A microphone array apparatus  
comprising:  
              a microphone array including microphones;  
              a sound source position detector which  
5       detects a position of a sound source on the basis of  
output signals of the microphones;  
              a camera generating an image of the sound  
source;  
              a second detector which detects the position  
10      of the sound source on the basis of the image from the  
camera; and  
              an integrate decision processing unit which  
outputs information indicating the position of the  
sound source on the basis of the information from the  
15      sound source position detector and the information  
from the second detector.

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